## REMARKS

Favorable reconsideration of this application as presently amended and in view of the following discussion is respectfully requested.

Claims 18-36 are pending, Claims 18, 31, and 36 having been amended by way of the present amendment.

In the outstanding Office Action, Claim 18 was rejected under 35 U.S.C. §112, ¶2; and Claims 18-36 were rejected as being unpatentable over Siemens (UK 468,827) in view of Breitenbach et al. (U.S. Patent No. 4,785,138, hereinafter Breitenbach) and in further view of Grant (U.S. Patent No.5,325,008).

Claim 18 has been amended to address the 35 U.S.C. §112, ¶2 rejection. However, if the Examiner disagrees, the Examiner is invited to contact the undersigned to identify mutually agreeable claim language.

Applicants respectfully traverse the rejection of Claims 18-36 as being unpatentable over Siemens in view of Breitenbach and Grant. Independent Claims 18, 31, and 36 have been amended simply to clarify features that are believed to have already been present in the pending claims, but perhaps were misconstrued during the examination. In any event, it is respectfully submitted that each of the pending claims, as amended, patentably defines over the asserted prior art.

In order to appreciate the significant differences between the claimed invention and the asserted prior art, it is believed that a brief summary of selected features of the present invention is in order. The present invention is directed to rotating electric machines and methods for making the rotating electric machines that employ a winding disposed in slots of a stator that is exposed to a rotating magnetic field imparted by a rotor. Such machines may

be used as generators, for example, in power stations that generate electric power. Using a high-voltage cable for the winding allows for more winding turns, thus allowing for a greater voltage to be developed on the winding. Since a greater than normal voltage is developed on the winding, a sufficient amount of insulation is needed on the winding so as to avoid internal (or external) electrical discharge, which would eventually destroy the cable.

Constructing such rotating electric machines for high-voltage applications, particularly configurations that have a large number of windings, gives rise to a number of problems that are not present in conventional rotating machines (as well as non-rotating machines, such as linear motors like that discussed in <u>Breitenbach</u>). For example, by having many windings positioned next to each other in the relatively confined space of a stator slot and having those windings carry electrical currents at high voltages, gives rise to unique cooling problems and winding vibration problems that can cause the windings to become damaged (see e.g., specification page 2, lines 17-28). The operational stresses placed on the windings in such high voltage applications, has led others to attempt to employ various complex, and generally ineffective, mechanisms for providing such structures (see e.g. prior art examples discussed at page 2, line 8 to page 4, line 31).

The present invention employs a cable having an insulation system that includes an inner semiconducting layer, surrounded by an insulation layer, that in turn is surrounded by an outer semiconducting layer. This cable permits continuous use in a high-voltage application, without suffering from the cooling problems that would normally be present when such a device is operated in high-voltage applications.

Amended Claim 18 is directed to a method for manufacturing a stator with a stator winding for a rotating electric machine that includes drawing a high-voltage cable having an

outer semiconducting layer through a first slot and a second slot while a spring member in the slot is compressed, and subsequently, decompressing the spring member once the cable is drawn through the slot. The high-voltage cable makes a continuous full turn of the winding, and thus the turn does not have a joint in the end-winding region. This high-voltage cable includes an insulation system having an inner semiconducting layer, an outer semiconducting layer and a solid insulation layer disposed between the inner semiconducting layer and the outer semiconducting layer. The inner semiconducting layer and the outer semiconducting layer each constitute an equipotential surface.[1]

The winding of Claim 18 is continuous through at least two slots of the stator. This is a significant departure from conventional winding configurations. Conventional bar-type winding systems use individual bars per winding, and have joints to connect adjacent winding bars. The joints in the end-winding region of conventional machines pose many problems for machine engineers. A result of not having continuous windings and requiring joints, is that the fields are not contained within the windings. The electrical and mechanical forces resulting form the fields result in vibrations and other stresses that may damage the windings. By having a continuous winding through two or more slots, the joint between successive

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[1]One reason for including the outer semiconducting layer is to provide an equipotential surface that can be held at a predetermined voltage. The equipotential surface allows the cable to minimize the occurrence of arcing from the cable to other surfaces by providing a sufficiently resistive outer coating. At the same time the outer semiconducting layer minimizes the amount of eddy currents that are induced on the outer layer which create electrical losses, and therefore thermal loading problems for the electric machine, which might result in a failure. Accordingly, the outer semiconducting layer serves the dual function of not allowing significant current flow in the outer semiconducting layer, while simultaneously providing a mechanism for electric charge to be bled off of the outer semiconducting layer, thereby preventing arcing.

windings can be eliminated. By eliminating joints, the fields within the windings may be contained, and the problems of conventional winding systems can be avoided.

Claim 18 is rejected based on a hypothetical machine having a stator from the AC machine in Siemens, with a winding taken from a linear motor described in Breitenbach. Furthermore, the hypothetical machine employs spring members as described in Grant disposed between the stator from Siemens and the linear motor winding of Breitenbach. Applicants respectfully traverse this rejection.

Siemens, as shown in Figure 1 thereof, includes "a plurality of individually insulated slot conductors" (column 1, lines 18-19) shown as elements $a_1$-$a_3$ in Figure 1 in slots of a stator. The first conductor, conductor $a_1$, will have a lower potential, and therefore a thinner amount of insulation (insulation $i_1$) disposed around it. Likewise, separate conductors $a_2$ and $a_3$ include progressively greater amounts of insulation thereabout depending on the amount of electric potential developed on the separate conductors. The reason for using separate conductors in the machine in Siemens is so that if the different conductors become damaged, it is simple to replace a damaged section (column 1, lines 37-40). Also, applying progressively more insulation to conductors further from the core, enables those conductors with a low potential on them, to not have an unnecessary amount of insulation thereabout, while the outer conductors which have a higher potential will have a thicker insulation layer. Siemens explains that this graduation "ensures maximum utilisation of space" (column 1, lines 34-36). Accordingly, a basic feature of Siemens that helps achieve a maximum utilization of space and facilitate the replacement of a damaged section, is to employ groups of conductors, that are "separately insulated" (column 2, line 59).

The basic feature in Siemens of enabling the replacement of damaged sections of a winding is contrary to the objective of the present invention. By enabling the replacement of damaged sections of a winding, and by having sections of different cable dimensions, Siemens is not teaching a continuous winding as claimed in the present invention, but rather, a different approach altogether, that of segmenting the winding.

The outstanding Office Action recognizes that Siemens does not disclose a high-voltage cable but asserts that the high-voltage cable described in Breitenbach could be substituted for the conductor described in Siemens. The supposed rationale (or "motivation") is that "such a modification according to Breitenbach et al. would provide a cable that is flexible, having high conductance and well high [sic] load-carrying capacity" (Office Action page 4, lines 9-11). For the reasons discussed below, it is respectfully submitted that no such motivation would exist, as the objective in Siemens is not to provide a winding that has a higher conductance or a higher load carrying capacity, or even one that is flexible, but rather to solve the problem regarding the efficient use of space and the easy replacement of damaged conductors.

Breitenbach is directed to an electric cable for use as a phase winding for linear motors (see e.g., title). A linear motor does not suffer from the same cooling problems, space utilization problems, mechanical stress, and other stresses associated with the confined environment of a rotating electric machine. Linear motors are used in intermittent service, for example, as a motor power unit for trains or railway operations. The stator of a linear motor is stretched out lengthwise and may be many miles long (see e.g. Breitenbach column 3, lines 21-22). As such, it is immediately clear that a winding for a linear motor does not suffer from the same cooling problems or high magnetic-field related problems that would be

present in a confined space of a tightly wound high-voltage winding in a rotating electric machine.

The cable in Breitenbach employs a sheathing 10 that is made of a special material that has a particularly high conductivity (see e.g. columns 2, lines 32-33 and column 1, line 64). If such a cable with a highly conductive outer layer were to be employed in a rotating electric machine, the cable would be exposed to high magnetic fields. Since the protective sheathing of the cable in Breitenbach is highly conductive, eddy currents would be induced by the magnetic fields and would freely flow in the outer conductive surface, thereby giving rise to power loss and increased heat. Furthermore, the outer shield would tend to retain heat in the cable, which is not a problem for intermittent operation of linear motors where the stator is stretched out lengthwise for many miles. However, a shield that traps heat is not appropriate for use in the confined spaces of high voltage rotating machines where heat is not easily dissipated.

Furthermore, the cable described in Breitenbach has a uniform thickness, unlike the graduated thickness of insulator/conductor pairs in Siemens. This is not a problem when used in a linear motor winding application where the winding would not be subject to different voltage levels depending on where in the stator the winding was positioned, as is the case in a rotating electric machine. If the cable of Breitenbach were used in Siemens, the cable would either have too much insulation for use in an inner slot, or too little insulation for an outer slot. Accordingly, using the uniformly-dimensioned cable of Breitenbach in Siemens would defeat the stated objective of Siemens to maximize the utilization of space.

Since the respective features of the device in Siemens and the cable in Breitenbach have been discussed, the discussion is now turned to whether the single assertion made in the

outstanding Office Action regarding the motivation for combining the cable in Breitenbach with the stator in Siemens, is supported by any degree of rational motivation, or is merely a product of hindsight reasoning based on the disclosure of the present patent application. As previously discussed, the objectives in Siemens are to provide an alternating current machine that includes a plurality of individually insulated slot conductors that can be easily replaced when damaged, as well as gradually increased thicknesses of insulation around the conductor segments to maximize the utilization of space. Accordingly, a main feature of Siemens (replacing individual conductors when they fail) is not possible if the cable in Breitenbach were used to be disposed in different slots in the stator described in Siemens. For example, if the very long cable in Breitenbach were damaged, as described in Siemens (column 1, line 40), then the entire cable would presumably have to be replaced. On the other hand, the separate conductors described in Siemens are easily replaced when damaged.

Furthermore, Siemens recognizes that using separate conductors enables the use of different amounts of insulation around the conductors according to the voltage level that will be applied to each particular conductor. Accordingly, Siemens provides a structure in which an efficient amount of insulation is used around each of the conductors so that the maximum utilization of stator space is achieved. However, as discussed above, if the uniformly thick cable in Breitenbach were used in Siemens, then the cable would offer the same amount of insulation for all elements of the cable, regardless of the voltage load. Of course, this would not maximize the utilization of space in the stator.

Accordingly, it is respectfully submitted that one of ordinary skill in the art would not have been motivated to make the asserted substitution of Breitenbach's cable in the stator of Siemens since the substitution would not meet the objectives described in Siemens (namely,

space savings and simplified replacement of damaged conductors), and would give rise to both cooling problems and reliability problems, which would not be present in a linear motor application where the cable is distributed over many miles.

The outstanding Office Action asserts the motivation for combining the two references is that Breitenbach's cable would offer a flexible, high conductance and load-carrying capacity alternative to the separate conductors disclosed in Siemens. However, there is nothing to indicate in Siemens that there is a problem with the conductance or load-carrying capacity of the conductors used in Siemens. Moreover, Siemens provides a stator that recognizes that the load-carrying capacity varies as a function of where the winding turn is positioned relative to the stator core. Based on this recognition, the stator slot preserves a lesser amount of room for insulation for the more inwardly located winding turns, and a greater amount of insulation around the conductor at the outer turns. In contrast, the cable in Breitenbach is uniformly thick, which means that if the insulation for the outer turns is sufficiently thick, then there is too much insulation for use in the inner turns, and conversely, if the insulation for the inner turns is sufficiently thin, then there is too little insulation for use in the outer turns. For a proper obviousness rejection based on a combination of references there must be substantial evidence presented showing that there was a motivation to combine the references, not merely that it was feasible to combine the references. "Trade-offs often concern what is feasible, not what is, on balance, desirable. Motivation to combine requires the latter." Winner International Royalty Corp. v. Wang, 53 USPQ2d 1580, 1587 (Fed. Cir. 2000). Accordingly, it is respectfully submitted that the problems sought to be solved in Siemens are not at all addressed by the cable in Breitenbach, and thus there would be no desire to combine the references as asserted.

Consequently, the motivation asserted in the outstanding Office Action is unsupported by any evidence indicating that the proposed substitution is either technically feasible in a rotating electric machine application or in any way preferable over the structure already described in Siemens. Accordingly, it is respectfully submitted that one of ordinary skill in the art would not have been motivated to combine the cable in Breitenbach with the stator in Siemens.

Grant is asserted for its description of using spring members to hold a winding in stator slots. As can be seen in Figure 1, the winding 14 is a "stator bar" (col 4, line 57) and not a cable, and thus the springs are flat, not in an arc shape, as would be used to support a cable. Aside from the springs, there is nothing in Grant that would cure the above described deficiencies with regard to combining Siemens and Breitenbach. Consequently, it is respectfully submitted that no matter how Siemens is combined with Breitenbach and Grant, the proposed combination fails to teach or suggest the invention defined by independent Claim 18, as amended, as well as the other pendent claims, Claims 19-36.

Consequently, in view of the present amendment and in light of the foregoing comments, it is respectfully submitted that the invention defined by Claims 18-36, as amended, is definite and patentably distinguishing over the asserted prior art. The present

application is therefore believed to be in condition for formal allowance and an early and favorable reconsideration of this application is therefore requested.

Respectfully submitted,

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